

## **In the Translation of the Specification**

***Please replace paragraph [0001] with the following:***

### **Technical Field**

~~The present invention~~ This disclosure relates to a reflector for lighting for reflecting and distributing light from a light source.

***Please replace paragraphs [0003] through [0007] with the following:***

As a three-dimensional structure material using the conventional polymer membrane material, for example, the three-dimensional structure obtained by bonding the polymer membrane on an aluminum plate and bending the aluminum plate has been disclosed in ~~Patent Reference 1~~ Japanese Patent Application Laid-Open (JP-A) No. 11-198284 (paragraphs [0022] to [0045]) as the reflector for lighting. The structure material is strong and can hold the shape firmly. However, when a product receives an external force during a processing process and transportation or the like, distortion tends to remain in the product shape, and it is difficult to exhibit an optical performance at the time of the design. In addition, it is also difficult to install the product on a frame. The weight is heavy, and it is difficult to realize a complicated shape which is formed by deeply bending and in which various shape is compounded.

For example, in Japanese Patent Application Laid-Open (JP-A) No. 2003-22701 (paragraphs [0012] to [0018]), one obtained by bending and processing a white polymer membrane having a thickness of about 1 mm has been disclosed. However, the structure material had problems that the raw material tends to be fractured when a bent part thereof is bent deeply or extended at the time of a processing process and installation, and stress distortion tends to remain in a film material, and thereby it is difficult to maintain highly precise shape.

~~[Patent Reference 1] Japanese Patent Application Laid-Open (JP-A) No. 11-198284 (paragraphs [0022] to [0045])~~

~~[Patent Reference 2] Japanese Patent Application Laid-Open (JP-A) No. 2003-22701 (paragraphs [0012] to [0018])~~

**Disclosure of the Invention**

**Problems to be solved by the Invention**

It is ~~an object of the present invention~~ could therefore be helpful to provide a reflector for lighting which has shape holding property, flexibility and lightweight property.

#### Means for solving the Problems Summary

~~So as to solve the problems, the present invention has~~ We provide the following: constitution.

[1] A reflector for lighting comprising:

a reflective material 1 made of a polymer membrane of which an average reflectance of 400 to 700 nm wavelength of at least one surface side is 85% or more and having a ridge-shaped uneven shape; and

a reinforcing material having flexibility,

wherein the reinforcing material connects the bottom parts of concave parts with each other from the back side of the one surface side of the reflective material 1 to reinforce the uneven shape (a reflector for lighting of the first ~~present invention~~ aspect).

[2] The reflector for lighting according to the above item [1], wherein the reflective material 1 and the reinforcing material are made of a polyester film.

[3] The reflector for lighting according to the above item [1] or [2], wherein the reflective material 1 has a groove formed on at least a back side of an edge line part of a convex part.

[4] The reflector for lighting according to any of the above items [1] to [3], wherein the reflector contains a plurality of reflective materials.

[5] The reflector for lighting according to the above item [4], wherein the reflector contains a plurality of reflective materials 1.

[6] The reflector for lighting according to the above item [4] or [5], further comprising a reflective material 2 made of a polymer membrane of which an average reflectance of 400 to 700 nm wavelength of at least one surface side is 85% or more and having no ridge-shaped uneven shape.

[7] The reflector for lighting according to any of the above items [4] to [6], wherein the reflector contains a connection material for connecting a plurality of reflective materials.

[8] The reflector for lighting according to the above item [7], wherein the reflective material 1, the reinforcing material and the connection material are made of a polyester film.

[9] The reflector for lighting according to any of the above items [1] to [8], wherein the reflective material made of the polymer membrane of which the average reflectance of 400 to 700 nm wavelength of at least one surface side is 85% or more forms a side part continuing from the bottom part of the reflector, and has a groove formed on the back side of the one surface side on the boundary of the bottom part and the side part.

[10] A reflector for lighting, comprising a reflective material made of the polymer membrane of which the average reflectance of 400 to 700 nm wavelength of at least one surface side is 85% or more, forming a side part continuing from the bottom part of the reflector, and having a groove formed on the back side of the one surface side on the boundary of the bottom part and the side part (a reflector for lighting of the second ~~present invention aspect~~).

[11] A back light device for displaying information using the reflector for lighting according to any one of the above items [1] to [11].

#### **Effect of the Invention**

~~The present invention can~~ We provide a reflector for lighting which has shape holding property, flexibility and lightweight property. That is, there can be provided the reflector for lighting which reproduces the optical design faithfully and has excellent handling property at the time of installation and conveyance such as positioning in a mounting work to a frame or the like.

***Please replace the section title on page 10 and paragraph [0049] with the following:***

***[Best Mode for Carrying Out the Invention] Detailed Description***

[[A]] Our reflector for lighting ~~of the present invention~~ has a reflective material made of a polymer membrane. The polymer membranes shown by the following items (1) to (4) and having apparent whiteness are a preferable aspect.

- (1) A polymer membrane obtained by adding organic and inorganic dyes, and organic and inorganic particulates or the like to thermo-plastics;
- (2) A polymer membrane obtained by mixing the constituting resin component with a resin and/or organic or inorganic particles being incompatible with the resin component, melting and extruding, and then drawing the extruded resin in the at least one direction to form minute voids in the resin;

- (3) A polymer membrane foamed by adding fizzy particles, melting and extruding; and
- (4) A polymer membrane extruded and foamed by injecting gas such as carbon dioxide or the like.

***Please replace paragraph [0053] with the following:***

Various kinds of additive agents, for example, a heat-resistant stabilizer, an antioxidant stabilizer, a lubricant, organic and inorganic particulates, a light-resistant agent, an antistatic agent, a nucleating agent and a coupling agent or the like may be added into the reflective material by kneading and application or the like within the range where the effect of the present invention is not inhibited. For example, so as to exhibit the optical characteristic stably over a long period of time, it is preferable to contain the light-resistant agent, and it is more preferable to have a protective layer containing the light-resistant agent at the upper surface side. There can be used an organic light stabilizer such as hindered amine system, salicylic acid system, benzophenone system, benzotriazole system, cyanoacrylate system, triazine system, benzoate system and an oxalic acid anilide system as the light-resistant agent, and a copolymerization polymer including the light stabilization structures thereof, or an inorganic light stabilizer such as sol gel. Examples of the light-resistant agents suitably used are shown below. These may be used singly or in combination of two kinds or more.

Hindered amine system:

bis(2,2,6,6-tetramethyl-4-piperidyl)sebacate, dimethyl succinate-1-(2-hydroxyethyl)-4-hydroxy-2,2,6,6-tetramethylpiperidine polycondensate.

Salicylic acid system: p-t-buthylphenylsalicilate, p-octhylphenylsalicilate.

Benzophenone system:

2,4-dihydroxybenzophenone, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-methoxy-5-sulfobenzophenone, 2,2'-4,4'-tetrahydroxybenzophenone, 2,2'-dihydroxy-4-methoxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, bis(2-methoxy-4-hydroxy-5-benzoylphenyl)methane.

Benzotriazole system:

2-(2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(2'-hydroxy-5'-tert-butylphenyl)benzotriazole, 2-(2'-hydroxy-3',5'-di-tert-buthylphenyl)benzotriazole, 2-(2'-hydroxy-3'-tert-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3',5'-di-tert-

butylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-5'-t-octylphenol)benzotriazole, 2-(2'-hydroxy-3',5'-di-tert-amylphenyl)benzotriazole, 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazole-2-yl)phenol], 2(2'-hydroxy-5'-metacryloxyphenyl)-2H-benzotriazole, 2-[2'-hydroxy-3'-(3'',4'',5'',6''-tetrahydrophthalimidemethyl)-5'-methylphenyl]benzotriazole, 2-(2'-hydroxy-5'-acryloyloxyethylphenyl)-2H-benzotriazole, 2-(2'-hydroxy-5'-metacryloxyethylphenyl)-2H-benzotriazole, 2-(2'-hydroxy-3'-tert-buthyl-5'-acryloylethylphenyl)-5-chloro-2H-benzotriazole.

Cyanoacrylate system: ethyl-2-cyano-3,3'-diphenylacrylate.

Other than those above:

nickel bis(octylphenyl)sulfide, [2,2'-thiobis(4-t-octylphenolate)]-n-buthyl amine nickel, nickel complex-3,5-di-t-buthyl-4-hydroxybenzyl phosphoric acid monoethylate, nickel-dibuthyldithiocarbamate, 2,4-di-t-buthylphenyl-3',5'-di-t-buthyl-4'-hydroxybenzoate, 2,4-di-t-butylphenyl-3',5'-di-t-butyl-4'-hydroxybenzoate, 2-ethoxy-2'-ethyloxacacidbisanilide, 2-(4,6-diphenyl-1,3,5-triazine-2-yl)-5-[(hexyl)oxy]-phenol.

***Please replace paragraph [0054] with the following:***

In the reflector for lighting ~~of the present invention~~, the reflective characteristic of the reflective material is defined by the 85% or more average reflectance of 400 to 700 nm wavelength of at least one surface side. The average reflectance of 400 to 700 nm wavelength is obtained by measuring the spectreflectance of the wavelength range of 400 to 700 nm at an interval of 10 nm according to JIS Z 8722 to calculate the arithmetic average value of each measured value. So as to enhance reflective efficiency, the average reflectance is preferably 87% or more, more preferably 90% or more, and still more preferably 95% or more.

***Please replace paragraphs [0056] through [0059] with the following:***

A material compounded according to the use can be used for the reflective material used for the reflector for lighting ~~of the present invention~~. For example, so as to enhance the reflective efficiency, the use of ~~bonded~~ two bonded materials having a different reflective characteristic is one of preferable aspects. In a use in which the leak of light to the reverse side of the reflector for

lighting is ~~despised~~ not wanted, it is one of preferable aspects to bond a coloring film such as a black film and a metal foil. The specific examples of composite suitably used are shown below.

Combined partner raw material:

polyester film, polyolefin film, polyamide film, polyurethane film, polyphenylene sulphide film, aluminum foil, iron foil, copper foil

Combined method: cohesion, adhesion, heat fusion.

It is also one ~~[[of]]~~ preferable ~~aspects~~ aspect to form a shading layer, a heat transmission layer, a conductive layer and an insulating layer on the back side of the material constituting the reflective material by printing or vapor deposition. A combined part is not limited to the whole area of the constituting material, and a separate combined form may be used for only a part or every part.

In the reflector for lighting ~~of the present invention~~, plane shape, uneven shape such as ridge shape, wave pattern, sawtooth, rough skin, parallel crosses, checkered pattern and dimple, and the combination thereof or the like can be suitably designed and used according to demands such as optical characteristic, installation property and handling enhancement as the surface shape of the reflective material. It is also a preferable aspect to form the shape on the back side of the reflector for lighting so as to attain demands for easy installation property and enhancement in handling property or the like while reducing the optical influence and physical restriction of the surface of the reflector for lighting. Since the optical influence on the surface of the reflector is small particularly when the shape is formed by bonding the members, the range where the material, size and shape of the raw materials to be bonded can be selected is preferably spread. It is a preferable aspect to form the shape on the raw material constituting the back side of the reflector for lighting in the reflective material using the composite material from the same reason.

The reflective material may have a finer ridge-shaped projection which is not reinforced by a reinforcing material to be described later in addition to the ridge-shaped uneven shape of the reflective material 1 described below. The ridge-shaped projection is a preferable aspect since it is difficult to bend when a thin reflector having ~~lightweight~~ light weight is treated. The shape, arrangement and combination of the ridge-shaped projection can be selected according to structures required on the handling property and design of the reflector for lighting. For example, so as to reduce the optical influence and physical restriction due to the ridge-shaped projection, the arrangement constitution of the ridge-shaped projection under a light source is a preferable aspect.

Referring to the size of the ridge-shaped projection, the width and the height are preferably 0.5 to 10 mm, more preferably 0.5 to 5 mm, and still more preferably 1 to 3 mm. A means for forming the ridge-shaped projection can be selected from a bending processing, a heat press and a bonding of bar members or the like according to the demand characteristic and the manufacture process of the reflector for lighting.

The reflector for lighting of ~~[[the]]~~ a first ~~present invention~~ aspect has a reflective material 1 made of the polymer membrane whose the reflectance of at least one surface side is 85% or more and having the ridge-shaped uneven shape. The mixture of the lights of line light sources such as a fluorescent light and a cold cathode tube can be prevented by provision of the reflective material 1 having the ridge-shaped uneven shape, and a clear display can be enabled by efficiently using the line light source as a face light source.

***Please replace paragraph [0064] with the following:***

In the reflector for lighting ~~of the present invention~~, it is a preferable aspect to contain a plurality of reflective materials for realizing industrially the shape of a reflector faithful to an optical design.

***Please replace paragraph [0066] with the following:***

In addition to the reflective material 1, it is preferable aspect to further contain the reflective material 2 ~~specified in the present invention~~ and having no ridge-shaped uneven shape for realizing the reflector for lighting having the shape of the light source and the complicated surface shape corresponding to the arrangement. For example, when using the reflector for lighting ~~of the present invention~~ using a plurality of U-shaped cold cathode tubes, as an example shown in FIG. 13, it is one of preferable aspects that the reflective material 1 having ridge-shaped ~~unevennesss~~ unevenness is arranged so as to sandwich the straight line part of the cold cathode tube, and a plane-like reflective material is arranged at a part at which the cold cathode tube is bent for simultaneously pursuing optical design and physical limited condition. When it is necessary to install a member for supporting the light source on the reflector for lighting in a back light device or the like for large-sized liquid crystal TV, it is one of the preferable aspects that a part in which a member supporting the light source is installed enlarges the area of a plane-like reflector and a part in which the

supporting member does not need to be installed enlarges the area used as three-dimensional structure for simultaneously pursuing optical design and physical limited condition.

***Please replace paragraphs [0069 and [0070]] with the following:***

In the reflector for lighting ~~of the present invention~~, the shape of the boundary of the reflective materials can be designed according to the demanded characteristic. For example, when the surface shapes of the combined reflective materials are different in a use requiring the surface continuity of reflective materials, it is a preferable aspect to cover a difference part by one reflective material and to block the difference part with a weather strip material. An example in which the difference in the surface shape is not particularly processed is shown in FIG. 17, and an example in which the difference part of the surface shape is blocked is shown in FIGS. 18 and 19. It is a preferable aspect to superpose and use the combined reflective materials so as to obtain the continuity of the functional side in the difference part. Examples superposed and used are shown in FIGS. 20 and 21.

A reflector for lighting of the first ~~present invention~~ aspect comprises a reinforcing material having flexibility in addition to the reflective material 1, and is characterized in that the reinforcing material connects the bottom parts of concave parts with each other from the back side of the side of the one surface of the reflective material 1 to reinforce the uneven shape. The reflector for lighting provided with flexibility, lightweight property and shape holding property as the polymer material can be realized by the provision of the constitution.

***Please replace paragraph [0079] with the following:***

When the reflector for lighting ~~of the present invention~~ contains the above-mentioned plurality of reflection materials, it is preferable to contain the connection material for connecting them for preventing a desired optical characteristic from being ruined by the position gap of the reflection material.

***Please replace paragraphs [0087] and [0088] with the following:***

Whether the whole of the contact surface of the reflective material and connection material is integrated or partially integrated needs only to be suitably selected according to the use or the



constituent raw material. It is a preferable aspect to integrate ~~whole~~ the whole contact surface of the reflective material and reinforcing material so as to integrate firmly, and it is preferable to partially integrate since the heat shrinkage ratio difference and the thermal expansion ~~ratio~~ ratio difference are absorbed and it is difficult to generate the distortion of structure as the whole reflector for lighting.

A means for integrating the reflective material and the reinforcing material needs only to be suitably selected according to the use, and examples thereof include a binder, an adhesive, heat fusion, hook stop, bis stop and sewing machine engagement. For example, it is one of the preferable aspects to integrate the reinforcing material formed of a polyester biaxial drawing film with the reflective material using the binder since the reflective material is not degraded by a thermal or physical damage.

***Please replace paragraphs [0090] through [0094] with the following:***

~~In the present invention, it~~ It is possible to realize a reflector for lighting having a complicated shape by reinforcing the reflective material 1 cut out into a shape as shown in FIG. 23 using the reinforcing material after applying the ridge-shaped uneven shape of FIG. 24 to the reflective material 1.

Next, in the reflector for lighting of ~~[[the]]~~ a second ~~present-invention~~ aspect, the reflective material forms a side part continuing from the bottom part of the reflector, and has a groove formed on the back side of the side of the one surface on the boundary of the bottom part and side part. Though the conventional article adopts a perforated line which usually have a penetrated part on the boundary of the bottom part and side part, the adoption of the groove can prevent damage from the boundary of the bottom part and side part when installing the reflector and correcting the wrong installation while having the good installation property following the internal shape of a lighting case. Also, it is a preferable aspect so as to prevent the remarkable degradation of surface shape and quality of the material such as fracture on the boundary of the bottom part and side part to faithfully reproduce the optical design. It is preferable that the boundary of the bottom part and side part has substantially no penetrated part in view of the prevention of light leaking from the penetrated part.

As the groove and reflective material in the second ~~present-invention~~ aspect, those in the above first ~~present-invention~~ aspect can be used.

It is also preferable that the first ~~present invention~~ and ~~[[the]]~~ second ~~present invention~~ aspects are combined.

In the reflector for lighting ~~of the present invention~~, for maintaining the optical characteristic at the time of the design, the size of the long side of the bottom side and size of the short side of the bottom side before and after exposure under the environment of 70°C and 90% RH for 24 hours are respectively set to  $W_0$ ,  $W$ ,  $L_0$ ,  $L$ . When the absolute values of the difference of the amount of dimensional change before and after exposure are set to  $\Delta W (= |W_0 - W|)$  and  $\Delta L (= |L_0 - L|)$ ,

$\Delta W/W_0 \leq 0.02$  and  $\Delta L/L_0 \leq 0.02$  are preferable,

$\Delta W/W_0 \leq 0.01$  and  $\Delta L/L_0 \leq 0.01$ , are more preferable, and

$\Delta W/W_0 \leq 0.007$  and  $\Delta L/L_0 \leq 0.007$  are even more preferable.

***Please replace paragraph [0096] with the following:***

Since the reflector for lighting ~~of the present invention~~ can easily obtain the three-dimensional structure reflecting any optical design corresponding to various light source shapes, the reflector for lighting can be used as a particularly preferable aspect as the back light device for displaying information such as the light source for signboards and the back light for liquid crystal TV.

***Please replace paragraph [0200] with the following:***

Industrial applicability

Since the reflector for lighting ~~of the present invention~~ can easily obtain the three-dimensional structure reflecting any optical design corresponding to various light source shapes, the reflector for lighting can be used as an aspect particularly preferable aspect as the back light device for an display information such as the light source for signboards and the back light for liquid crystal TV.